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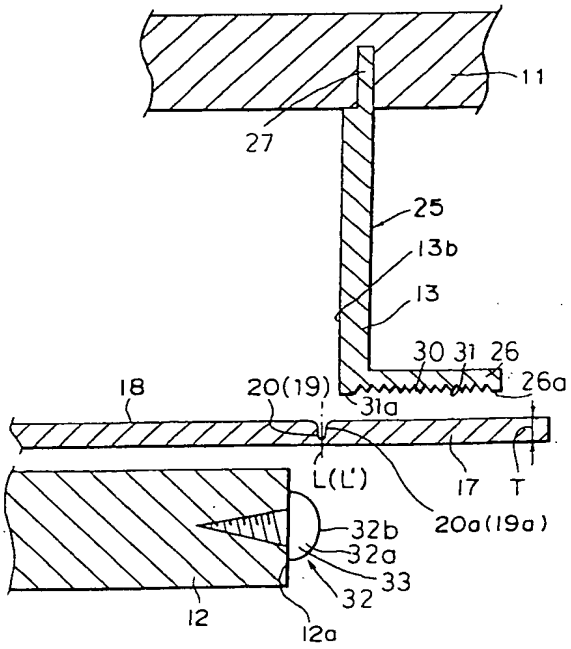
(54) Waste removing apparatus for use in punching machine for manufacturing carton.

(57) A waste removing apparatus, for use in a punching machine for manufacturing a carton, for separating from each other a waste region (17) of a sheet and a product region (18) of the sheet having a punching line (12) comprising a cut-out portion (19) and a remaining portion (20) formed thereon and inserted between an upper die (11) and a lower die (12) which are approached to each other, by pressing down the waste region and tearing the remaining portion by means of a punching member (13) projecting downward from one of the dies so as to remove the waste region from the sheet. A plurality of grooves (30) is formed on a surface (26a) of the punching member to be brought into contact with a surface of the waste region to form pressing portions (31) between the grooves at regular intervals.

Fig. 3



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BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a waste removing apparatus, of a punching machine for manufacturing a carton, for removing a waste region from a sheet inserted between a pair of dies and more particularly, a waste removing apparatus for punching, or cutting the sheet along punching lines defined thereon in a preceding process by means of a punching member projecting downward from one of the dies so as to remove, from the sheet, a waste region disposed outside a punching line defining a product region and a waste region to be formed into a hollow region on the product region.

Description of the Related Arts

An example of a conventional waste removing apparatus of this kind is described below with reference to Fig. 26. The apparatus removes, from a material sheet 1, a waste region 3A disposed outside a product region 2 and partitioned from the product region 2 along an outer punching line (L) defined along the periphery of the product region 2 and a waste region 3B disposed inside the product region 2 and partitioned from the product region 2 along an inner punching line (L') defined along the periphery of a hollow region to be formed on the product region 2. The outer punching line (L) and the inner punching line (L') are formed by a required punching operation in a preceding process.

The sheet 1 is perforated at predetermined intervals to form the punching lines (L) and (L') by the preceding process as shown in Fig. 27. Unperforated portions of the sheet 1 are referred to as a remaining portion 4.

The waste removing operation of the conventional apparatus is described below with reference to Figs. 28A and 28B. In this waste removing apparatus, a punching member 7A for cutting the sheet 1 along the outer punching line (L) and a punching member 7B for cutting the sheet 1 along the inner punching line (L') project downward from a substrate 6 of an upper die 5, whereas a substrate 9 which is a little smaller than the product region 2 of the sheet 1 is fixed to a lower die 8 via a supporting frame 10. In this construction, the upper die 5 is moved downward so that the punching members 7A and 7B hang the waste regions 3A and 3B on the remaining portion 4, thus tearing the remaining portion 4 from the product region 2 and removing the waste regions 3A and 3B from the product region 2.

As described above, in this waste removing apparatus, the punching members 7A and 7B press the upper surface of the waste regions 3A and 3B downward, thus bending the sheet 1 along the outer and inner punching lines (L) and (L') and tearing the remaining portion 4 connecting the waste regions 3A and 3B with the product region 2 supported by the substrate 9.

In order for the punching members 7A and 7B to bend the sheet 1 and separate the waste regions 3A and 3B from the product region 2 by applying a great load to the waste regions 3A and 3B, it is preferable that the punching members 7A and 7B are disposed not immediately about the outer and inner punching lines (L) and (L') but slightly outward and inward, respectively, i.e, the punching members 7A and 7B are disposed in the waste regions 3A and 3B. That is, a gap is defined between the punching members 7A and 7B and the outer and inner punching lines (L) and (L'), respectively in a horizontal direction.

In the above-described waste removing operation, if a width W1 of the waste region 3A is large, it is necessary to apply a great load to the waste region 3A so as to separate the waste region 3A from the product region 2 by tearing the remaining portion 4. The conventional waste removing apparatus is so constructed that the vertical length of the punching member 7A is unalterable. Therefore, if the width W1 of the waste region 3A is large and the vertical length of the punching member 7A is small, a sufficient load is applied to portions of the waste region 3A disposed along the outer punching line (L) while a sufficient load is not applied to portions of the waste region 3A distant from the outer punching line (L). Thus, it may occur that the sheet 1 cannot be bent smoothly by pressing the waste region 3A downward.

When the width W1 of the waste region 3A is small, the punching member 7A is incapable of applying a great load to the waste region 3A. Thus, it may happen that the waste region 3A is not separated from the product region 2 by tearing the remaining portion 4.

That is, in the waste removing apparatus, as described previously, the outer edge of the substrate 9 is disposed inward of the outer punching line (L) with a gap defined between the outer edge of the substrate 9 and the outer punching line (L) so that the sheet 1 can be bent easily by pressing the waste region 3A downward along the outer punching line (L) and that the punching member 7A does not collide with the substrate 9. This construction causes a portion of the waste region 3A which has been moved downward by the punching member 7A to be inserted into a gap between the outer edge of the substrate 9 and the punching member 7A. As a result, the outermost portion of the waste region 3A approaches to the outer punching line (L) to an extent more than required. Consequently, the punching member 7A is brought

into contact with the waste region 3A in a small area. That is, the punching member 7A is incapable of applying a sufficient load to the waste region 3A. Accordingly, it is difficult to tear the remaining portion 4.

In removing the waste region 3B corresponding to the hollow region from the sheet 1, it is necessary to dispose the punching member 7B in the vicinity of the inner punching line (L'). The conventional punching member 7B is solid made of metal and has an unalterable vertical length. Therefore, the known punching member 7B is large in size and heavy in weight, and thus a large driving force is required.

If the punching member 7B is so manufactured that the punching member 7B is brought into contact with the sheet 1 in a large area to apply a great load to the entire sheet 1, there is a possibility that the sheet 1 is inclined downward toward the waste region 3B or from the punching line, or the cutting line if the sheet 1 has a small thickness.

In addition, if the punching member 7B is brought into contact with the sheet 1 in a large area, there is a possibility that the sheet 1 is not detached from the punching member 7B and moved upward together with the punching member 7B when the punching member 7B is moved upward after the waste removing operation is completed.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an apparatus having improved punching members for separating a waste region of a sheet from a product region thereof along a perforated punching or cutting line formed on the sheet and removing the waste region from the sheet.

In accomplishing the above and other objects, in a waste removing apparatus, for use in a punching machine for manufacturing a carton, for separating from each other a waste region of a sheet and a product region of the sheet having a punching line comprising a cut-out portion and a remaining portion formed thereon and inserted between an upper die and a lower die which are approached to each other, by pressing down the waste region and tearing the remaining portion by means of a punching member projecting downward from one of the dies so as to remove the waste region from the sheet, a plurality of grooves are formed on a surface of the punching member to be brought into contact with a surface of the waste region to form pressing portions between the grooves at regular intervals.

The grooves of the punching member may be v-shaped in section and formed successively; and V-shaped pressing portions may be formed between the grooves.

The grooves of the punching member may be U-shaped in section, so that an edge is formed on each of the pressing portions formed between the grooves.

Preferably, the pressing portion adjacent to the punching line is a little longer than the other projections.

The punching member comprises a vertical portion and a horizontal portion continuous with one end of the vertical portion; the other end of the vertical portion is formed as a fixing portion to be embedded in a substrate of one of the dies; the vertical portion is disposed on the waste region side with the fixing portion fixed to the substrate; and an outer surface of the horizontal portion is brought into contact with the waste region.

The punching member is L-shaped in section; the vertical portion is disposed along the punching line and on the waste region side; and the horizontal portion extends from one end of the vertical portion toward an outer end of the waste region.

A stepped portion projecting toward the punching line is formed on the side of the vertical portion confronting the punching line at a position spaced by a predetermined interval from the horizontal portion so that an end portion of the stepped portion is brought into contact with the cut-out portion of the punching line, which is forced to be horizontal by the pressing portion formed on the horizontal portion.

Preferably, a V-shaped projection is formed on the end portion of the stepped portion so that V-shaped projection is brought into contact with the cut-out portion.

The configuration of the punching member is set in any desired configurations. For example, the lower ends of the vertical portions of two L-shaped punching member are connected with each other by means of the horizontal portions; and the grooves and pressing portions are formed on the horizontal portions.

A lower portion of the vertical portion of the punching member is upward tapered; and the grooves and pressing portions are formed on the lower surface of the punching member.

The area of a substrate of the other die to which the punching member is not fixed is set to be a little smaller than the area of a region surrounded with the punching line; and the substrate is fixed to the die via a supporting frame projecting from a portion of a peripheral surface of the substrate; two L-shaped punching members are arranged with a gap provided on both sides of horizontal portions of the punching member projecting in opposite directions; ends of vertical portions disposed between the gap are connected with each other; and a fixing portion projects from a connect-

ing portion connecting the ends of the vertical portions; and the gap is opposed to the supporting frame so as to separate the waste region and press down the waste region on both sides of the supporting frame.

Two U-shaped punching members are arranged with a gap provided therebetween; ends of vertical portions disposed on both sides of the gap are connected with each other; and a fixing portion projects from a connecting portion connecting the ends of the vertical portions; and the gap is opposed to the supporting frame so as to separate the waste region from the product region and press down the waste region on both sides of the supporting frame.

As the punching member for the a small waste region to be formed as a hollow region on the product region, the punching member a cylindrical or square pillar; grooves are formed on a surface of the punching member to be brought into contact with a surface of the waste region to form pressing portions between the grooves; and an edge is formed on each pressing portion.

The grooves are U-shaped or V-shaped.

As the punching member for a large waste region to be formed as a hollow region on the product region, the punching member is hollow cylindrical and both ends thereof are open; and the grooves are formed at regular intervals on a peripheral surface of the punching member to be brought into contact with the surface of the waste region to form pressing portions at regular intervals between the grooves.

The punching member is hollow cylindrical, hollow semi-cylindrical or hollow square pillarlike and both ends are open.

A plurality of thick portions projecting outward in opposite directions in the widthwise direction of the punching member and a plurality of thin portions are formed alternately with each other on the punching member; and grooves are formed on the surface of the punching member to be brought into contact with the surface of the waste region to form pressing portions between the grooves.

Preferably, each thick portion projects in a V-shaped configuration in opposite directions in the widthwise direction of the punching member. Preferably, the thick portions and the thin portions are arranged at small intervals.

When the punching member comprising the thick portions and the thin portions is used by arranging them straight in a row, preferably, it is disposed along the punching line formed along the periphery of the product region. When the punching member is used by curving the thin portions, it may be disposed along the punching line defined along the periphery of the waste region to be formed as a curved hollow region.

Preferably, the punching member is made of metal; and the substrate is made of wood.

Preferably, a fixing portion of the punching member is pressed into a hole formed in the substrate.

According to the waste removing apparatus of the present invention, a plurality of grooves and the pressing portion formed of a plurality of projections are defined on the contact side (lower side) of the punching member at regular intervals. Therefore, the pressing portion contacts the waste region at many points, thereby applying a great load to the waste region. In addition, the grooves prevent the pressing portion from slipping on the waste region. Therefore, the pressing portion bends the sheet reliably and smoothly along the punching line, thus removing the waste region from the sheet.

The projection of the pressing portion adjacent to the punching line which is longer than other projections applies a great load to the waste region along the punching line, thereby bending the sheet and tearing it along the punching line.

The horizontal portion extends from the lower end of the vertical portion of the punching member fixed to the upper die substrate and projecting downward is also brought into contact with the waste region. This construction allows the pressing portion to contact the waste region in a great area and prevents the punching member from being heavy. Preferably, the punching member is made of aluminum to make it light.

The punching member having the stepped portion formed on the vertical portion thereof and confronting the punching line reliably tears the cut-out portion of the punching line which has become horizontal. The V-shaped projection formed by the formation of the stepped portion is brought into contact with the cut-out portion of the punching line having a small width (thin sheet), thereby tearing the cut-out portion.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and features of the present invention will become clear from the following description taken in conjunction with the preferred embodiments thereof with reference to the accompanying drawings, in which:

Fig. 1 is a schematic plan view showing the positional relationship of an entire waste removing apparatus according to a first embodiment of the present invention;

Fig. 2 is a perspective view showing a punching member 13 according to the first embodiment of the present invention;

Fig. 3 is a sectional view showing principal portions of the waste removing apparatus according to the first embodiment of the present invention;

Fig. 4 is a front view showing a punching member 14 according to the first embodiment of the present invention;
Fig. 5 is a front view showing a punching member 15 according to the first embodiment of the present invention;
Figs. 6A, 6B, 6C, and 6D are schematic views showing the operation according to the first embodiment of the present invention;
Fig. 7 is a sectional view showing principal portions of a waste removing apparatus according to a second embodiment of the present invention;
Figs. 8A, 8B, 8C, 8D and 8E are schematic views showing the operation according to the second embodiment of the present invention;
Fig. 9 is a front view showing a modification of the punching member 15;
Fig. 10 is a front view showing a modification of the punching member 14;
Fig. 11 is a front view showing a modification of the punching member 14;
Fig. 12 is a perspective view showing a punching member 14 according to a third embodiment of the present invention;
Fig. 13 is a plan view showing the installation position of the punching member 14 according to the third embodiment of the present invention;
Fig. 14 is a perspective view showing a modification of the punching member 14 according to the third embodiment of the present invention;
Fig. 15 is a plan view showing the installation position of the punching member 14 shown in Fig. 14;
Figs. 16A, 16B, and 16C are schematic views showing the operation to be performed by the punching member 14 shown in Fig. 14;
Fig. 17 is a perspective view showing a punching member 14 according to a fourth embodiment of the present invention;
Fig. 18 is a plan view showing the installation position of the punching member 14 shown in Fig. 17;
Figs. 19A, 19B, and 19C are schematic views showing the operation to be performed by the punching member 14 shown in Fig. 17;
Fig. 20 is a perspective view showing a modification of the punching member 14 according to the fourth embodiment of the present invention;
Fig. 21A is a plan view showing a modification of the punching member 14 according to the fourth embodiment of the present invention;
Fig. 21B is a front view showing a modification of the punching member 14 according to the fourth embodiment of the present invention;
Fig. 22A is a plan view showing a modification of the punching member 14 according to the fourth embodiment of the present invention;
Fig. 22B is a front view showing a modification of the punching member 14 according to the fourth embodiment of the present invention;
Fig. 23 is a perspective view showing a punching member 14 according to a fifth embodiment of the present invention;
Fig. 24A, 24B, and 24C are plan views showing the use state of the punching member 14 according to the fifth embodiment of the present invention;
Fig. 25 is a perspective view showing a modification of the punching member 14 according to the fifth embodiment of the present invention;
Fig. 26 is a perspective view showing a product to be formed by a conventional waste removing apparatus;
Fig. 27 is a plan view showing a punching line; and
Fig. 28A and 28B are sectional views showing the operation process of the conventional waste removing apparatus.

DETAILED DESCRIPTION OF THE INVENTION

Before the description of the present invention proceeds, it is to be noted that like parts are designated by like reference numerals throughout the accompanying drawings.

Referring now to Figs. 1 through 5, a waste removing apparatus for use in a punching machine according to a first embodiment of the present invention is described below.

Fig. 1 is an explanatory view showing the relationship among an upper die substrate 11, a lower die substrate 12, a punching line (L) of a sheet 10, and punching members 13, 14, and 15 to be installed on the upper die substrate 11.

To serve the convenience of description, a product region 18 separated from waste region is set to be a simple configuration in this embodiment, namely, rectangular, as shown in Fig. 3 and has a rectangular hollow region 16 formed thereon. A waste region 17 disposed outside the product region 18 and a waste region 17' to be formed as the hollow region 16 disposed on the product region 18 are removed by the punching members 13, 14, and 15 shown in Figs. 2, 4, and 5, respectively.

Punching lines (L) and (L') comprising a cut-out portion 19 (Fig. 3) and a remaining portion 20 both formed in a preceding process are defined on the sheet 10 along the periphery of the product region 18 and that of the hollow region 16, respectively. The remaining portion 20 connects the product region 18 and the waste regions 17 and 17' with each other.

In addition to the punching lines (L) and (L'), a punching line (L'') is formed at a portion, of the

sheet 10, corresponding to the position of a supporting frame 21 which will be described later so that a waste region is removed from the sheet 10 along the punching line (L") by the punching member.

The upper die substrate 11 is moved upward and downward by a driving means (not shown), whereas the lower die substrate 12 is installed at a predetermined position by the supporting frame 21, with one end of the supporting frame 21 fixed to the lower surface of the lower die substrate 12 and projecting from the peripheral surface of the lower die substrate 12 and the other end of the supporting frame 21 fixed to the lower die (not shown). The upper die substrate 11 is approached to the lower die substrate 12 by moving the upper die substrate 11 downward to separate the waste regions 17 and 17' from the product region 18, while upper die substrate 11 is moved away from the lower die substrate 12 by moving the upper die substrate 11 upward.

As shown in Fig. 3, the punching member 13 approximately L-shaped in section and made of aluminum projects downward from the upper die substrate 11. The punching member 13 is disposed outward from the punching line (L) by providing a slight interval therebetween.

The punching member 13 comprises a vertical portion 25 and a horizontal portion 26 making a right angle with the vertical portion 25. The outer end of the horizontal portion 26 is near the outer end of the waste region 17.

A thin fixing portion 27 formed at the upper end of the vertical portion 25 is fixed to the upper die substrate 11 made of wood, by inserting the fixing portion 27 into a groove formed therein.

A plurality of grooves 30 sectionally V-shaped is formed on the lower surface, namely, the outer surface 26a of the horizontal portion 26 which is brought into contact with the waste region 17 by spacing them at regular intervals so as to form a V-shaped pressing portion 31. Of V-shaped projections of the pressing portion 31, a projection 31a disposed on the punching line-side is longer than the other projections by approximately 1 mm so that a stronger pressing force is applied to a portion (innermost portion) of the waste region 17 adjacent to the punching line (L) when the punching member 13 is brought into contact with the waste region 17.

A vertical peripheral surface 12a of the lower die substrate 12 is inward of the punching line (L) by a predetermined distance.

A projection 33 consisting of the head 32a of a screw 32 is formed on the vertical peripheral surface 12a at a position opposed to the remaining portion 20 of the punching line (L). The screw 32 is screwed into the vertical peripheral surface 12a.

The screw head 32a constituting the projection 33 is approximately semispheric. The tangent to the top 32b of the screw head 32a coincides with an extension of the punching line (L).

As shown in Fig. 4, the punching member 14 for removing the waste region to be formed as the rectangular hollow region 16 disposed on the product region 18 is made of aluminum similarly to the punching member 13 and approximately U-shaped in section. The horizontal portion 26 connects the lower ends of a pair of vertical portions 25A and 25B. The V-shaped grooves 30 are successively formed on the lower surface 26a of the horizontal portion 26 so as to form the V-shaped pressing portion 31.

The vertical portions 25A and 25B are disposed along the punching line (L'), on the shorter side of the hollow region 16, defined along the periphery thereof. Projections 31a disposed at both ends of the pressing portion 31 and adjacent to both punching lines (L') are a little longer than the other projections of the pressing portion 31.

A fixing portion 27 is formed on the upper end of each of the vertical portions 25A and 25B. The fixing portion 27 is embedded in the upper die substrate 11.

The punching member 15 is projected downward from the upper die substrate 11 at a portion corresponding to the position of the supporting frame 21 projecting from the peripheral surface of the lower die substrate 12.

The punching member 15 serves as a means for separating and dropping the waste region 17 by pressing force from the product region 18 along the punching line (L") continuous with the punching line (L) defined along the periphery of the product region 18 and extending toward the periphery of the waste region 17.

In the punching member 15, two sectionally U-shaped component parts are arranged in parallel with each other by spacing them at a certain interval. The upper end of vertical portions 25A and 25A' disposed on both sides of the interval are connected with each other via a connecting portion 40. A fixing portion 27 projects from the connecting portion 40. Another fixing portion 27 also projects from the upper end of each of vertical portions 25B and 25B' disposed at both sides of the punching member 15.

The sectionally V-shaped pressing portion 31 projects downward from the lower surface of each horizontal portion 26 interposed between the vertical portions 25A and 25B and between the vertical portions 25A' and 25B'.

A gap 41 defined between the vertical portions 25A and 25A' is opposed to the supporting frame 21 so that the waste region 17 is separated from the product region 18 and dropped on both sides

of the supporting frame 21 by pressing force.

Referring to Figs. 6A through 6D, the operation of removing the waste region 17 from the sheet 10 to be performed by the waste removing apparatus is described below.

As shown in Fig. 6A, initially, the sheet 10 is fed to the upper surface of the lower die substrate 12. At this time, the punching line (L) is disposed at approximately the center between the vertical peripheral surface of the projection 33 and the outer vertical surface 13b of the punching member 13.

Then, as shown in Fig. 6B, the upper die substrate 11 is moved downward. As a result, the pressing portion 31 projecting downward from the lower surface 26a of the horizontal portion 26 of the punching member 13 is brought into contact with the upper surface of the waste region 17 of the sheet 10. With a further downward movement of the pressing portion 31, the pressing portion 31 presses the waste region 17 downward, thus pivoting the waste region 17 on the remaining portion 20, as shown in Fig. 6C.

As shown in Fig. 6C, as the pressing portion 31 moves downward further, the waste region 17 keeps pivoting until it makes a right angle with the horizontal portion 26 of the punching member 13. Consequently, the cut-out portion 20a of the remaining portion 20 (cut-out portion 19a of cut-out portion 19) which has been vertical becomes horizontal as a result of the pivotal motion of the waste region 17.

The waste region 17 hung on the remaining portion 20 by the pressing portion 31 becomes vertical in contact with the projection 33 formed on the vertical peripheral surface 12a of the lower die substrate 12. Therefore, the cut-out portion 20a becomes horizontal.

With a further downward movement of the punching member 13, the cut-out portion 20a is torn by the pressing portion 31a after the cut-out portion 20a of the sheet 10 becomes horizontal due to the pressing of the pressing portion 31. That is, as shown in Fig. 6D, the waste region 17 can be separated from the product region 18.

In the above-described waste removing operation, the pressing portion 31 presses the waste region 17 downward in close contact therewith because the projections of the pressing portion 31 are V-shaped and spaced from each other at regular intervals. Accordingly, the waste region 17 can be hung on the remaining portion 20. In this manner, the waste region 17 can be reliably removed from the sheet 10 by tearing the remaining portion 20.

The punching members 14 and 15 start to move downward simultaneously with the start of the downward movement of the punching member 13. As a result, the punching members 14 and 15 press the waste regions 17' and 17 downward, respectively, with the pressing portion 31 formed on the horizontal portion 26 disposed in the lower surface of each of the punching members 14 and 15 in contact with the waste regions 17' and 17. Thus, the waste region 17' to be formed as the hollow region 16 disposed on the product region 18 can be reliably separated from the product region 18 along the punching line (L') and dropped by the pressing portion 31. The waste region 17 is separated from the product region 18 at the portion corresponding to the position of the supporting frame 21 along the punching line (L'').

A waste removing apparatus according to a second embodiment of the present invention is described below with reference to Figs. 7 and 8. In the punching member 13 according to the second embodiment, a stepped portion 28 projecting toward the punching line (L) is formed on the vertical portion 25 at a position spaced at a predetermined distance from the lower end thereof. Therefore, a sectionally V-shaped projection 29 is formed immediately below the stepped portion 28.

The width W2 of the stepped portion 28 is so set that the projection 29 is brought into contact with the cut-out portions 19a and 20a and the lower surface of the horizontal portion 26 is brought into contact with the upper surface of portions, of the waste region 17, outward of the punching line (L) when the pressing force is applied to the cut-out portion 19 of the sheet 10 or the remaining portion 20 and as a result, the cut-out portions 19a and 20a become horizontal. Accordingly, the width W2 of the stepped portion 28 is set to be large when the thickness (T) of the sheet 10 is large, whereas the width W2 of the stepped portion 28 is set to be small when the thickness (T) of the sheet 10 is small.

The waste removing operation of the punching member 13 according to the second embodiment is performed as shown in Figs. 8A through 8E. The operations shown in Figs. 8A through 8C are similar to those of the punching member 13 according to the first embodiment.

As shown in Fig. 8C, the waste region 17 pivoted and hung on the remaining portion 20 by the pressing portion 31 becomes vertical in contact with the projection 33 formed on the vertical peripheral surface 12a of the lower die substrate 12. Therefore, the cut-out portions 20a and 19a become horizontal.

After the cut-out portions 20a and 19a of the sheet 10 become horizontal due to the pressing of the pressing portion 31 due to the downward movement of the punching member 13, the stepped portion 28 of the vertical portion of the punching member 13 is brought into contact with the cut-out portions 20a and 19a.

At this time, the cut-out portions 20a and 19a can remain locked reliably by the projection 29 because the configuration of the projection 29 is V-shaped in section.

As the projection 29 moves downward further from the state shown in Fig. 8D, the projection 29 forces the cut-out portions 19a and 20a to be almost vertical, thus tearing the remaining portion 20, as shown in Fig. 8E. In this manner, the waste region 17 can be separated from the product region 18.

During the operation shown in Fig. 8D to Fig. 8E, the waste region 17 is sandwiched between the projection 33 and the pressing portion 31 and thus kept to be almost vertical. Thus, the projection 29 presses the cut-out portions 19a and 20a downward. In this manner, the remaining portion 20 can be torn reliably from the product region 18.

Fig. 9 shows a modification of the punching member 15 set at a position corresponding to the position of the supporting frame 21. The punching member 15 comprises two sectionally L-shaped component parts, with the horizontal portions 26 and 26 thereof projecting in opposite directions with an interval 41 provided therebetween. The upper ends of the vertical portions 25 and 25 are connected with each other. The fixing portion 27 projects from the connecting portion 40. The interval 41 is opposed to the supporting frame 21.

Fig. 10 shows a modification of the punching member 14 for removing the waste region to be formed as the hollow region disposed on the product region 18. The punching member 14 has a circular horizontal portion 26 formed at the lower end of the vertical portion 25. The pressing portion 31 is formed on the lower surface 26a of the horizontal portion 26. The punching member 14 is preferably used for the circular hollow region.

Fig. 11 also shows a modification of the punching member 14. The punching member 14 has an upward tapered portion 25a in a lower portion of the vertical portion 25. A wide lower surface 25b of the punching member 14 is brought into contact with the waste region 17'. V-shaped pressing portion 31 is formed on the lower surface 25b of the punching member 14 such that respective projections are spaced from each other at regular intervals.

A waste removing apparatus according to a third embodiment of the present invention is described below with reference to Figs. 12 and 13. Fig. 12 shows the punching member 14 for removing the waste region to be formed as the hollow region 16 from the product region 18.

The lower side (upper side in Fig. 12), of the punching member 14, which is brought into contact with the waste region is rectangular. A cross-shaped groove 30 is defined on the lower side of the punching member 14 so as to form the pressing portion 31 comprising four rectangular projections having edges 31b.

The rectangular punching member 14 is preferably used to remove the waste region to be formed as the rectangular hollow region 16 as shown in Fig. 13. If the area of the hollow region 16 is small, one punching member 14 is used, whereas if the area thereof is large, two punching members 14 are used by arranging them in combination.

Because the pressing portion 31 is flat, the pressing portion 31 is brought into contact with the waste region in a large area. In addition, the edge 31b defined thereon prevents the pressing portion 31 from slipping on the waste region.

Fig. 14 shows a modification of the punching member 14 according to the third embodiment. The punching member 14 is semi-cylindrical. The punching member 14 has two grooves 30, parallel with each other, defined on the lower side (upper side in Fig. 14) thereof with a certain interval provided therebetween. Therefore, the pressing portion 31 comprising three projections is formed on the lower side of the punching member 14. Similarly to the third embodiment, an edge 31b is formed on each projection.

As shown in Fig. 15, the semi-cylindrical punching member 14 is preferably used to remove the waste region to be formed as the circular hollow region 16. As shown in Fig. 15, two punching members 14 are used by arranging them in opposition to each other.

The waste removing operation of the punching member 14 is performed as shown in Figs. 16A, 16B, and 16C. The pressing portions 31 presses the waste region 17 downward, thereby removing it from the sheet 10.

In addition to a rectangular configuration as shown in Fig. 12 or a semicircular configuration as shown in Fig. 14, the punching member 14 can be formed in any desired configurations such as a circular or polygonal configuration in accordance with that of the hollow region by forming grooves and a pressing portion formed of projections on the contact surface of the punching member 14.

A punching member according to a fourth embodiment of the present invention is described below with reference to Figs. 17 through 19. The punching member 14 according to fourth embodiment has upper and lower openings as shown in Fig. 17 and removes the waste region 17' so as to form the hollow regions 16A and 16B of the product region 18 as shown in Fig. 18. Two punching members 14 of Fig. 17 are used to form the elliptic hollow region 16B.

A plurality of grooves 30 is formed on the lower surface (upper surface in Fig. 17) of the punching member 14 by spacing them at regular

intervals in the circumferential direction of the contact (upper) surface. Consequently, projections of the pressing portion 31 are formed between adjacent grooves 30. The right-angled edge 31b is formed on each projection of the pressing portion 31.

Upper portions, of the peripheral wall of the punching member 14, opposed to each other in a diametrical direction of the contact (upper) surface are cut out to form the fixing portion 27 to be embedded in the upper die substrate 11.

Holes 35A and 35B slightly larger than the hollow regions 16A and 16B are formed in the lower die substrate 12 at positions corresponding to the hollow regions 16A and 16B of the product region 18. The punching member 14 is inserted into the holes 35A and 35B in moving the upper die substrate 11 downward.

The operation of removing the waste region 17 to form the hollow region 16 to be performed by the punching member 14 is described below with reference to Fig. 19. With the downward movement of the upper die substrate 11, the pressing portion 31 of the punching member 14 is brought into contact with the upper surface of the waste region 17' as shown in Fig. 19B, thus pressing it into the hole 35. At this time, the edge 31b formed on the projections of the pressing portion 31 prevents the pressing portion 31 from slipping on the waste region 17', thus allowing the pressing portion 31 to apply force generated due to the downward movement of the upper die substrate 11 to the waste region 17' uniformly.

In this manner, the punching member 14 tears the remaining portion 20 connecting the product region 18 and the waste region 17' with each other, thus separating the latter from the former even though the punching member 14 contacts the waste region 17' in a small area as shown in Fig. 19C. This is because the pressing portion 31 applies force to the waste region 17' uniformly and does not slip thereon.

After the waste region 17' is removed from the sheet 10, the upper die substrate 11 is moved upward. During the upward movement of the upper die substrate 11, air pressure present in the hollow cylindrical punching member 14 is applied to the product region 18 separated from the waste region 17', thus preventing the waste region 17' from moving upward.

Fig. 20 shows a modification of the punching member 14 according to the fourth embodiment. The punching member 14 is hollow and rectangular and thus open in the upper and lower sides thereof.

Figs. 21A and 21B also show a modification of the punching member 14 according to the fourth embodiment. The punching member 14 is hollow and approximately octagonal in section and thus open in the upper and lower surfaces thereof. Each side of the punching member 14 is curved toward the center thereof. The punching member 14 has also grooves 30 formed on the lower surface (upper surface in Figs. 21A and 21B) thereof. Consequently, projections composing the pressing portion 31 are defined between the adjacent grooves 30. This configuration allows the punching member 14 to have many edges which contact the waste region.

Figs. 22A and 22B also show a modification of the punching member 14 according to the fourth embodiment. The punching member 14 is hollow and semi-cylindrical and thus, the upper and lower surfaces thereof are open. Referring to Fig. 22A, V-shaped grooves 30' are defined on the straight and curved portions of the lower side of the punching member 14. Consequently, continuous projections of the pressing portion 31 formed between the adjacent grooves 30' apply a load to the waste region uniformly.

A punching member 14 according to a fifth embodiment of the present invention is described below with reference to Figs. 23, 24A, 24B, and 24C. The punching member 14 is formed by cutting a material 50 to a desired length. The material 50 comprises a plurality of component parts connected with each other in a direction (L).

The punching member 14 comprises thick portions 51 projecting in a V-shaped configuration on both sides in the widthwise direction thereof to form a hexagonal pillarlike configuration and rectangular solid thin portions 52 alternating with the thick portions 51.

As shown in Fig. 24A, 24B, and 24C, the punching member 14 can be formed in a desired curved configuration by curving the thin portions 52.

The lower surface (upper surface in Fig. 23) of the punching member 14 is brought into contact with the waste region 17' and the upper portion thereof is fixed to the upper die substrate. The upper portion of the thick portion 51 is cut out to form the fixing portion 27 in a rectangular solid configuration.

The upper side of the thin portion 52 is cut out in a desired depth to define grooves 30 thereon. Thus, the upper portion of the thick portion 51 serves as the pressing portion 31.

The punching member 14 according to the fifth embodiment can be used by arranging the thick portions 51 and the thin portions 52 straight in a row as shown in Fig. 23 or by curving the thin portions 52 in a desired configuration as shown in Figs. 24A, 24B, and 24C.

When the punching member 14 is used by arranging the thick portions 51 and the thin por-

tions 52 straight in a row as shown in Fig. 23, preferably, it is disposed along one side of a rectangular waste region 17' defined by the punching line (L'). In addition, the punching member 14 may be used as the punching member 13 by disposing it along the punching line (L) formed along the periphery of the product region 18.

When the punching member 14 is used by curving the thin portions 52 as shown in Figs. 24A, 24B, and 24C, it is disposed along the punching line (L') of the waste region 17' to be formed as the curved hollow region 16. Needless to say, the punching member 14 may be used as punching member 13 to remove the curved waste region 17 defined by the punching line (L).

Fig. 25 shows a modification of the punching member 14 according to the fifth embodiment. The groove 30 formed on the lower surface (upper surface in Fig. 25) of the punching member 14 extends through the center of the lower surface in the longitudinal direction (L) thereof. Consequently, projections defining the pressing portion 31 are formed at both sides of the groove 30.

As described above, according to the waste removing apparatus of the present invention, in order to remove the waste region of the sheet along the punching line defined along the periphery of the product region and that of the hollow region, a plurality of grooves and the pressing portion formed of a plurality of projections are defined on the contact side (lower side) of the punching member at regular intervals. Therefore, the pressing portion contacts the waste region reliably without the pressing portion slipping thereon, thereby applying load to the waste region and bending the sheet smoothly along the punching line.

Owing to the provision of the horizontal portion extending from the lower end of the vertical portion of the punching member, the punching member contacts the waste region in a large area. This construction allows the punching member to apply a large force to the waste region having a large width and prevents the punching member from being heavy, thus removing the waste region having a large width from the sheet reliably.

The punching member having the stepped portion formed on the vertical portion thereof is used to remove the waste region having a small width. In this case, the sheet is bent by the pressing portion along the punching line, namely, the cutting line. As a result, the cut-out portion of the punching line which has been vertical becomes horizontal. The stepped portion is brought into contact with the upper surface of the cut-out portion in its downward movement. As a result, the waste region hangs on the remaining portion. Then, the stepped portion tears the remaining portion, thereby separating the waste region from the product region.

The hollow punching member is lighter than the solid one and can be disposed along the punching line. Air pressure present in the punching member presses the waste region downward when the upper die substrate is moved upward, thus preventing the product and waste regions from moving upward, with the waste region sucked by the product region. Thus, the waste removing operation can be performed efficiently.

The pressing portion having the V-shaped pressing portion formed of projections and the right-angled edge formed on the pressing portion prevent the punching member from slipping on the waste region reliably when the pressing portion is brought into contact with the waste region. The punching member having this construction can be efficiently used to remove the waste region to be formed as the hollow region even though the punching member contacts is brought into contact with the waste region in a small area.

Although the present invention has been fully described in connection with the preferred embodiments thereof with reference to the accompanying drawings, it is to be noted that various changes and modifications are apparent to those skilled in the art. Such changes and modifications are to be understood as included within the scope of the present invention as defined by the appended claims unless they depart therefrom.

Claims

1. A waste removing apparatus used in a punching machine for manufacturing a carton, for separating from each other a waste region (17, 17') and a product region (18) of a sheet (10) having a punching line (L, L', L'') comprising a cut-out portion (19) and a remaining portion (20) formed thereon and inserted between an upper die (11) and a lower die (12) which are approached to each other, by pressing down the waste region and tearing the remaining portion by means of a punching member (13, 14, 15) projecting downward from one of the dies so as to remove the waste region from the sheet, characterized in that

   a plurality of grooves (30) is formed on a surface of the punching member to be brought into contact with a surface of the waste region so as to form pressing portions (31) between the grooves at regular intervals.

2. The waste removing apparatus as defined in claim 1, wherein the grooves (30) of the punching member are V-shaped in section and formed successively and the V-shaped pressing portions (31) are formed between the grooves.

3. The waste removing apparatus as defined in claim 1, wherein the grooves (30) of the punching member are U-shaped in section and an edge (31b) is formed on each of the pressing portions (31) formed between the grooves.

4. The waste removing apparatus as defined in anyone of claims 1 to 3, wherein the pressing portion (31a) adjacent to the punching line is a little longer than the other projections (31).

5. The waste removing apparatus as defined in anyone of claims 1 to 4, wherein the punching member (13; 14; 15) comprises a vertical portion (25; 25A, 25B; 25A', 25B') and a horizontal portion (26) continuous with one end of the vertical portion; the other end of the vertical portion is formed as a fixing portion (27) to be embedded in a substrate (11) of one of the dies; the vertical portion is disposed on the waste region side with the fixing portion fixed to the substrate; and an outer surface (26a) of the horizontal portion is brought into contact with the waste region.

6. The waste removing apparatus as defined in claim 5, wherein the punching member (13) is L-shaped in section; the vertical portion (25) is disposed along the punching line and on the waste region side; and the horizontal portion (26) extends from one end of the vertical portion toward an outer end of the waste region.

7. The waste removing apparatus as defined in claim 6, wherein a stepped portion (28) projecting toward the punching line is formed on the side of the vertical portion confronting the punching line at a position spaced by a predetermined interval from the horizontal portion so that an end portion (29) of the stepped portion is brought int contact with the cut-out portion (19a, 20a) of the punching line, which is forced to be horizontal by the pressing portion.

8. The waste removing apparatus as defined in claim 7, wherein a V-shaped projection (29) is formed on the end portion of the stepped portion so that the V-shaped projection is brought into contact with the cut-out portion.

9. The waste removing apparatus as defined in claim 5, wherein the lower ends of two vertical portions (25A, 25B) of the punching member (14) are connected with each other by means of the horizontal portions (26); and the grooves and pressing portions are formed on the horizontal portions.

10. The waste removing apparatus as defined in anyone of claims 1 to 4, wherein a lower portion (25a) of two vertical portions (25, 25a) of the punching member (19) is upward tapered; and the grooves and pressing portions are formed on the lower surface of the punching member.

11. The waste removing apparatus as defined in claim 1, wherein the area of a substrate (12) of the other die to which the punching member is not fixed is set to be a little smaller than the area of a region surrounded with the punching line; and the substrate is fixed to the die via a supporting frame (21) projecting from a portion of a peripheral surface of the substrate (12);

two L-shaped punching members (15') are arranged with a gap (41) between horizontal portions (26) of the punching member projecting in opposite directions; ends of vertical portions disposed on both sides of the gap are connected with each other; and a fixing portion (27) projects from a connecting portion (40) connecting the ends of the vertical portions; and

the gap (41) is opposed to the supporting frame (21) so as to separate the waste region and press down the waste region on both sides of the supporting frame.

12. The waste removing apparatus as defined in claim 1, wherein the area of a substrate (12) of the other die to which the punching member is not fixed is set to be a little smaller than the area of a region surrounded with the punching line; and the substrate is fixed to the die via a supporting frame (21) projecting from a portion of a peripheral surface of the substrate;

two U-shaped punching members (15) are arranged with a gap (41) provided therebetween; ends of vertical portions (25A, 25A') disposed on both sides of the gap are connected with each other; and a fixing portion (27) projects from a connecting portion (40) connecting the ends of the vertical portions; and

the gap (41) is opposed to the supporting frame (21) so as to separate the waste region and press down the waste region on both sides of the supporting frame.

13. The waste removing apparatus as defined in claim 1, wherein the punching member (14) is a cylindrical or square pillar; grooves (30) are formed on a surface of the punching member to be brought into contact with a surface of the waste region to form pressing portions between the grooves; and an edge (31b) is

formed on each pressing portion.

14. The waste removing apparatus as defined in claim 13, wherein the grooves (30) are U-shaped.

15. The waste removing apparatus as defined in claim 1, wherein the punching member (14) is hollow cylindrical and both ends thereof are open; and the grooves (30) are formed at regular intervals on a peripheral surface of the punching member to be brought into contact with the surface of the waste region to form pressing portions (31) at regular intervals between the grooves.

16. The waste removing apparatus as defined in claim 15, wherein the grooves are U-shaped or V-shaped.

17. The waste removing apparatus as defined in claim 15, wherein the punching member is hollow cylindrical, hollow semi-cylindrical or hollow square pillar-like and both ends are open.

18. The waste removing apparatus as defined in claim 15, wherein the area of a contact surface of the punching member is a little smaller than that of the waste region (17') to be formed as a hollow region (16).

19. The waste removing apparatus as defined in claim 1, wherein a plurality of thick portions (51) projecting outward in opposite directions from both vertical side surfaces of the punching member (14) and a plurality of thin portions (52) are formed alternately with each other on the punching member; and grooves (30) are formed on the surface of the punching member to be brought into contact with the surface of the waste region to form pressing portions (31) between the grooves.

20. The waste removing apparatus as defined in claim 19, wherein each thick portion (51) projects in a V-shaped configuration in opposite directions.

21. The waste removing apparatus as defined in claim 19, wherein the punching member is curved by bending the thin portions (52).

22. The waste removing apparatus as defined in claim 1, wherein the punching member (14, 14, 15) is made of metal and the substrate (11, 12) is made of wood.

23. The waste removing apparatus as defined in claim 22, wherein a fixing portion (27) of the punching member is pressed into a hole formed in the substrate.

Fig. 1

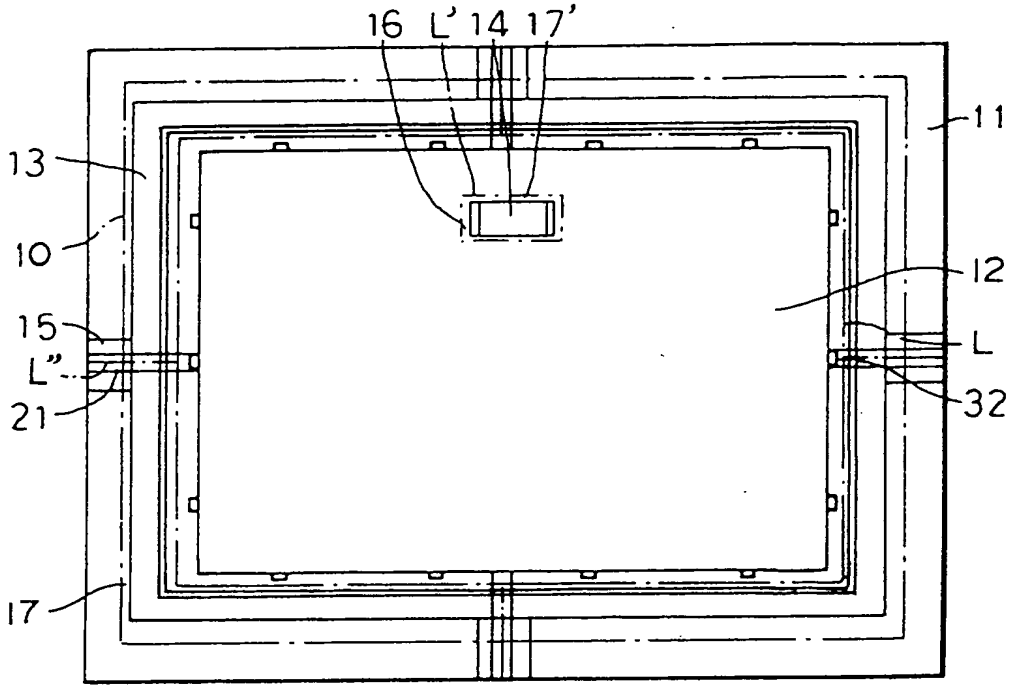

Fig. 2

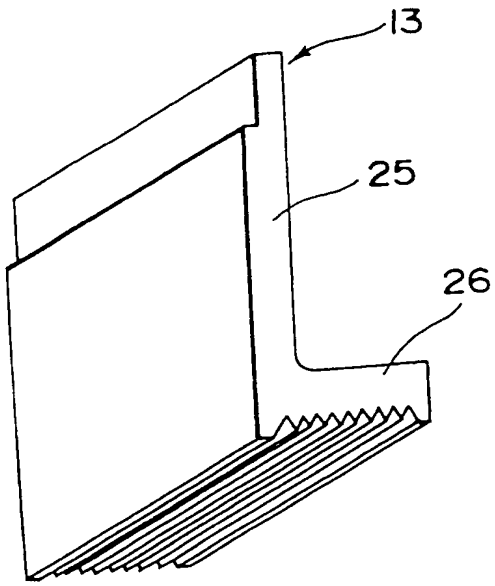

Fig. 9

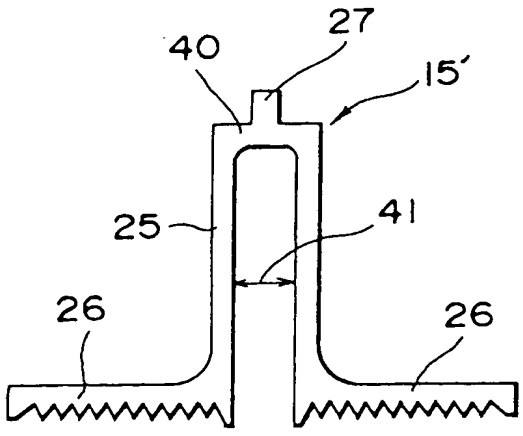

Fig. 3

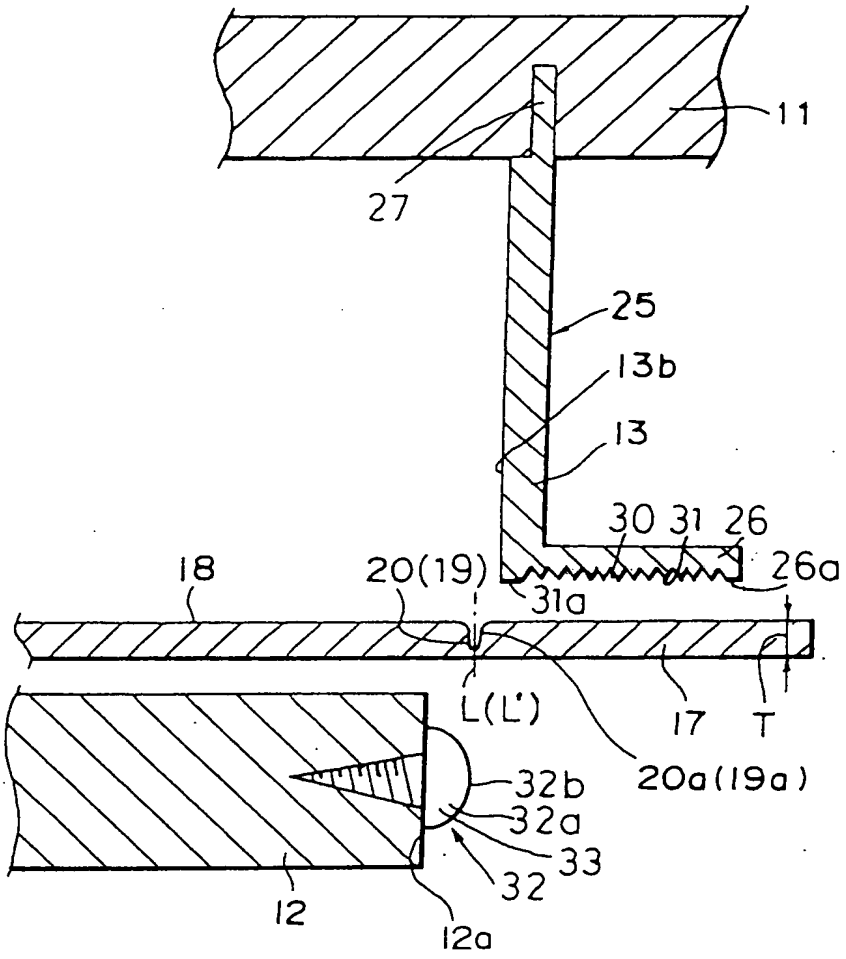
11
27
25
13b
13
30 31 26
26a
18
20(19)
31a
L(L')
17
T
20a(19a)
32b
32a
33
32
12
12a

Fig. 4

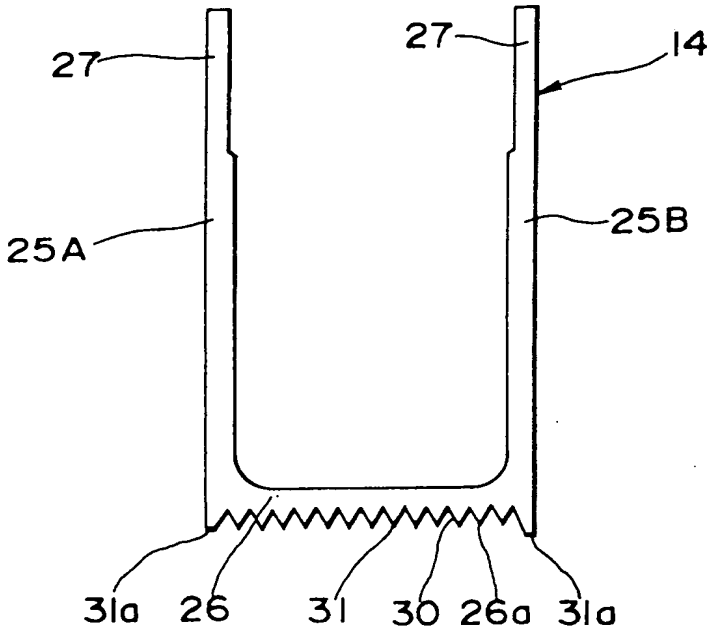
27
27
14
25A
25B
31a
26
31
30
26a
31a

Fig. 5

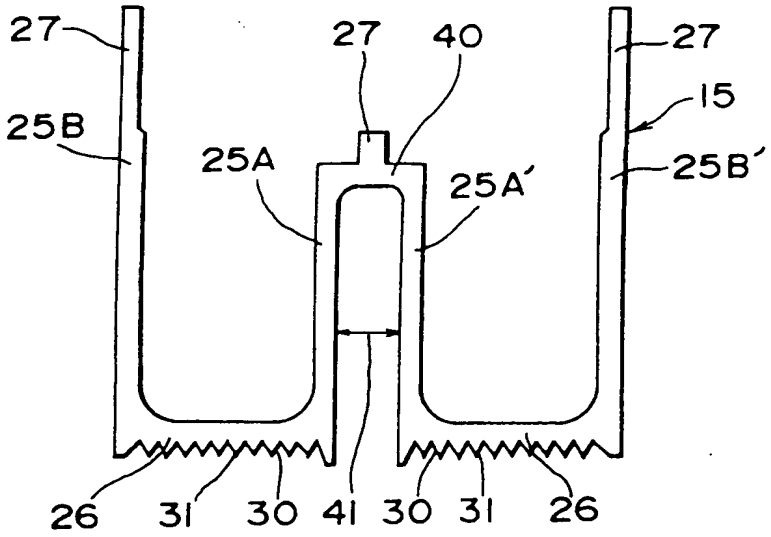
27
27
40
27
15
25B
25A
25A'
25B'
26
31
30
41
30
31
26

Fig. 6A

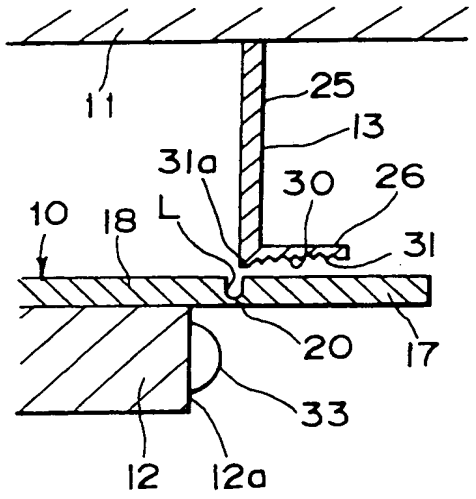

Fig. 6B

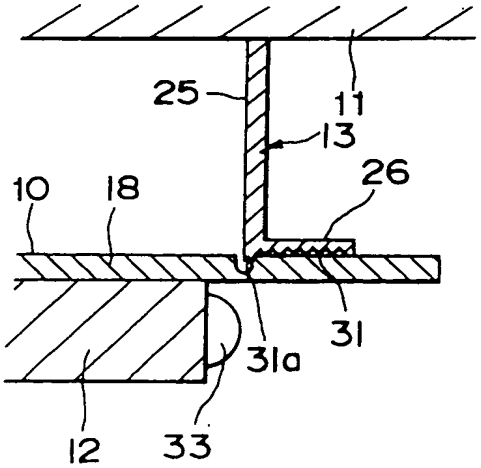

Fig. 6C

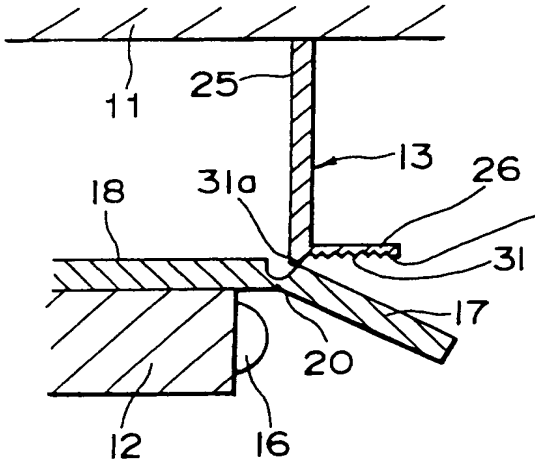

Fig. 6D

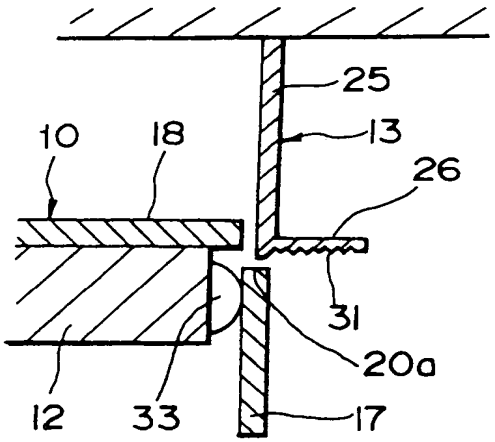

Fig. 7

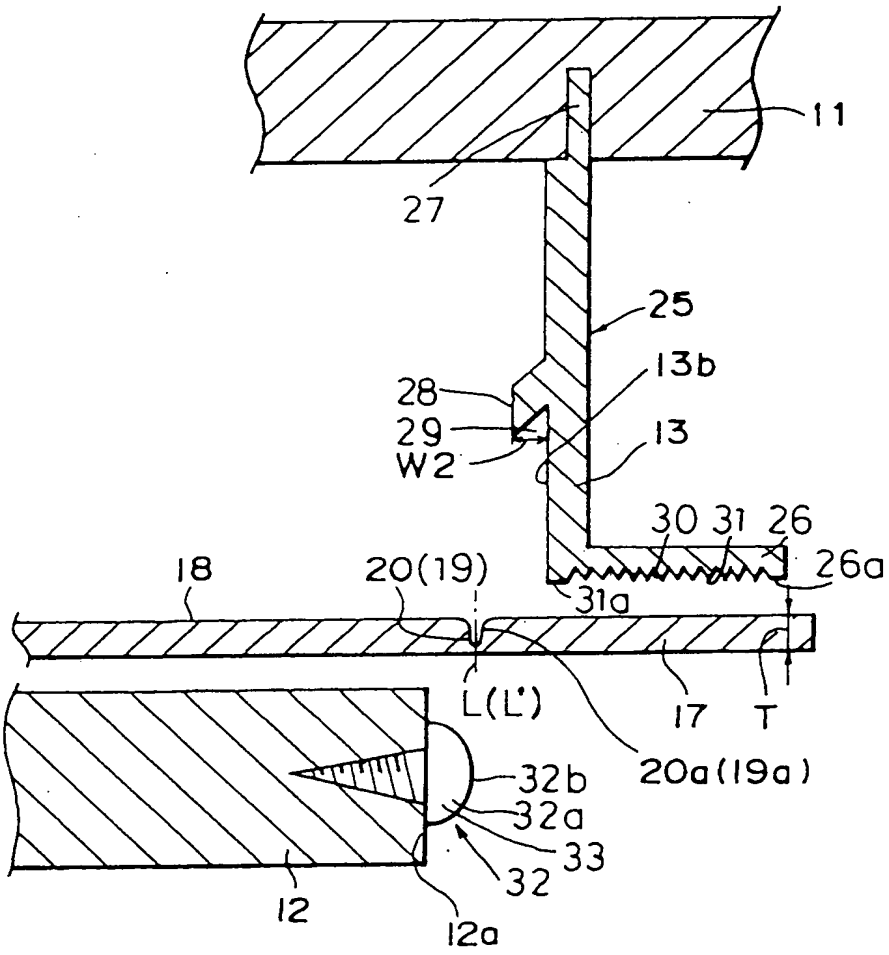
11
27
25
13b
28
29
W2
13
30 31 26
26a
18
20(19)
31a
L(L')
17
T
20a(19a)
32b
32a
33
32
12
12a

Fig. 8A

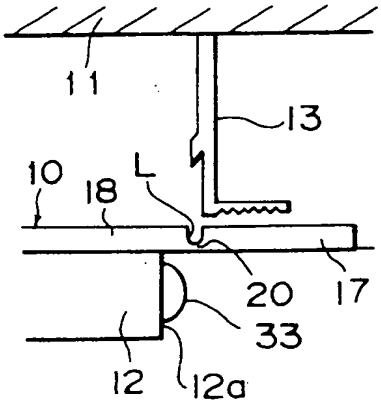

Fig. 8B

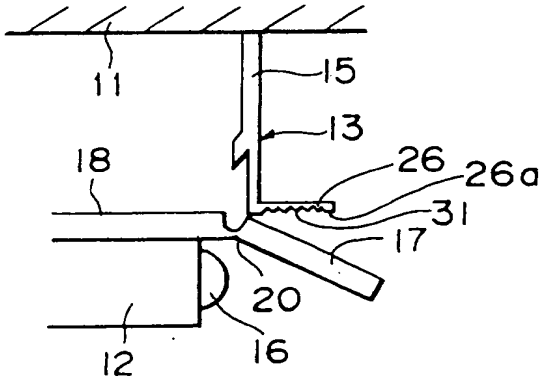

Fig. 8C

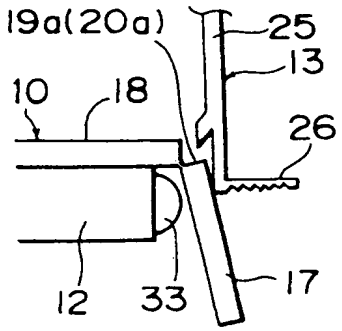

Fig. 8D

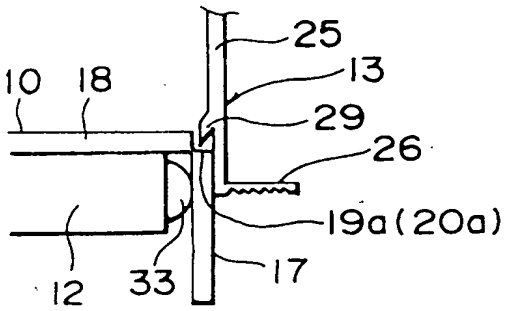

Fig. 8E

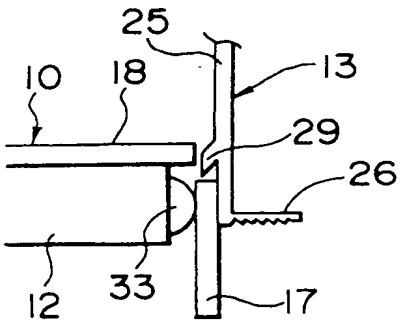

Fig. 10

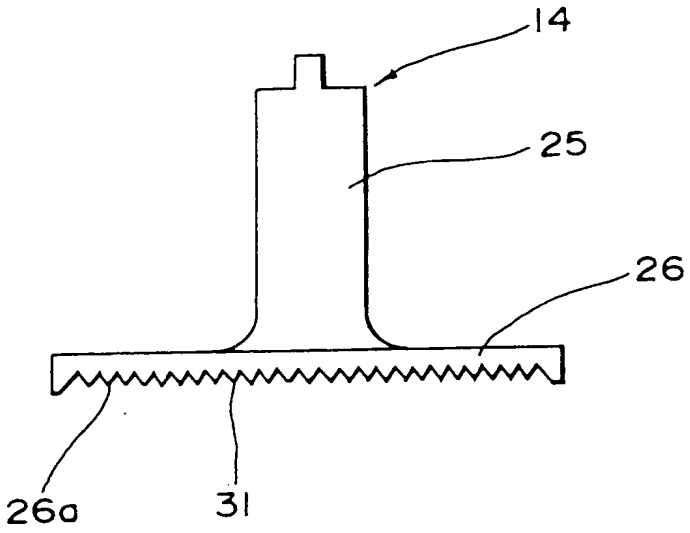

Fig. 11

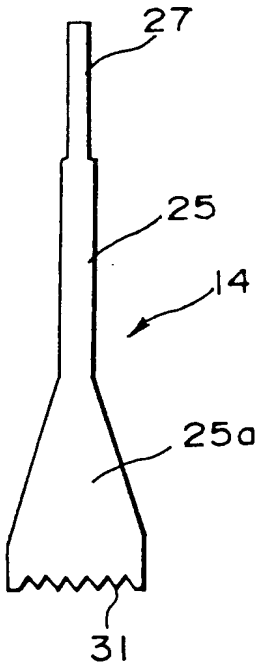

Fig. 12

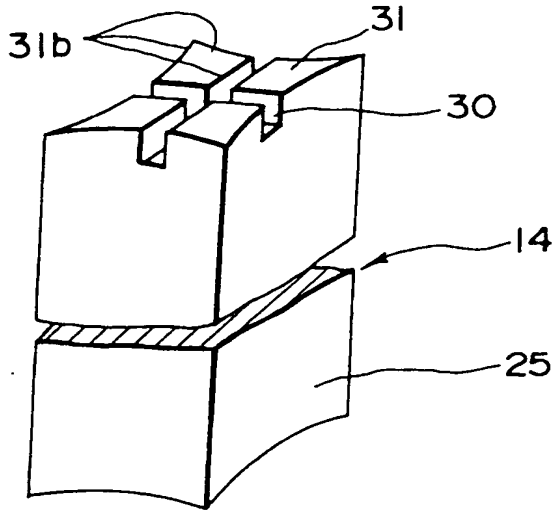

Fig. 13

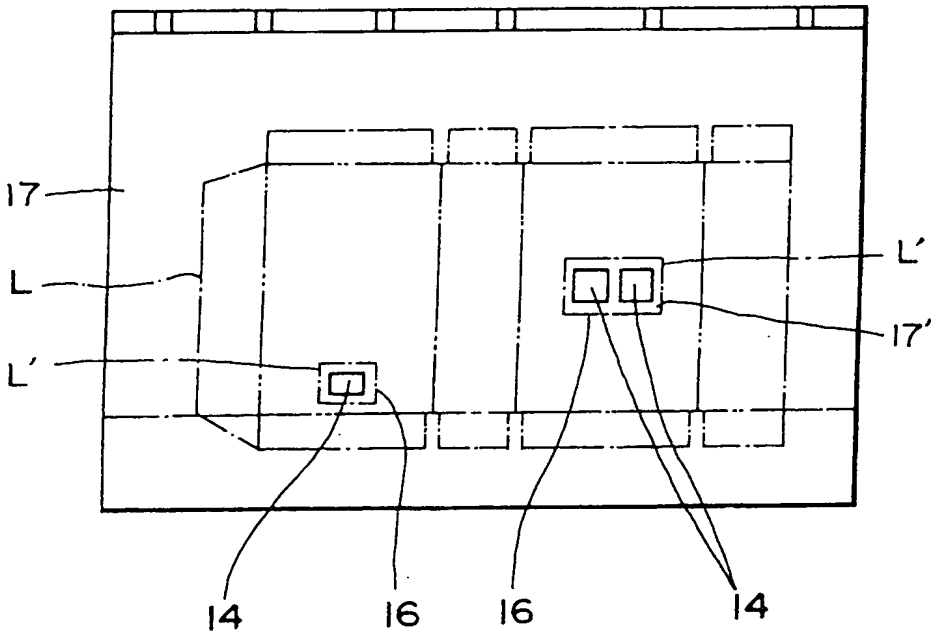

Fig. 14

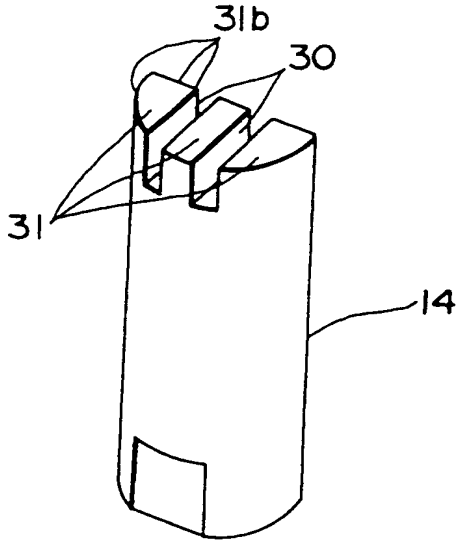

Fig. 15

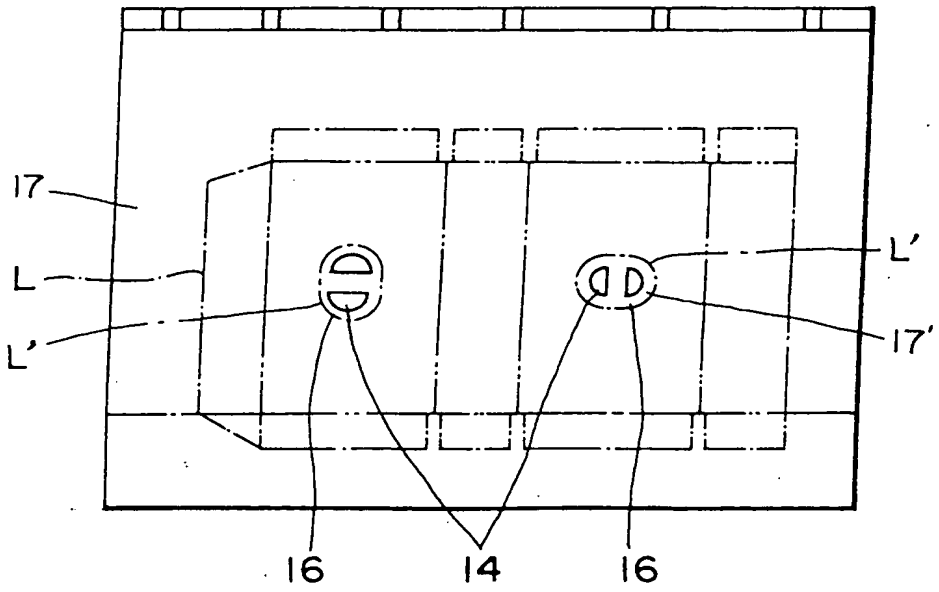

Fig. 16A

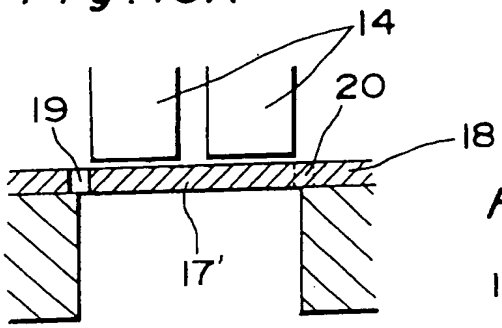

Fig. 16B

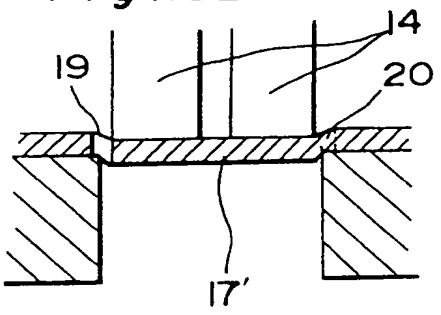

Fig. 16C

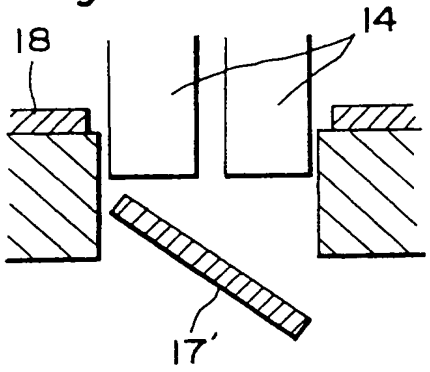

Fig. 17

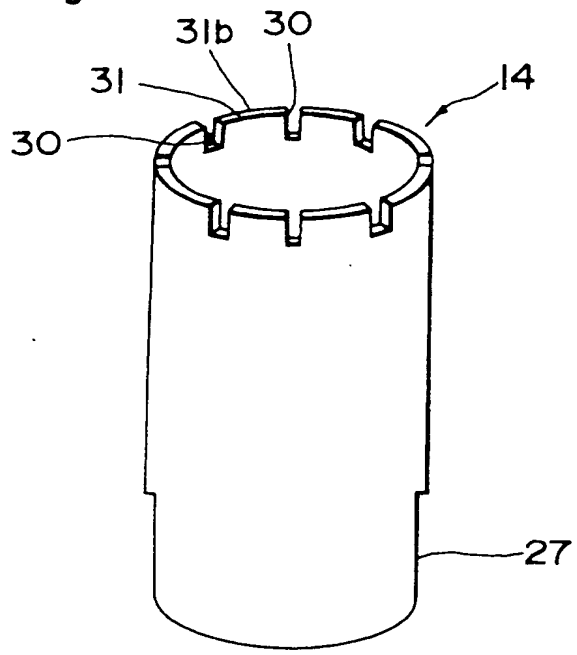

Fig. 20

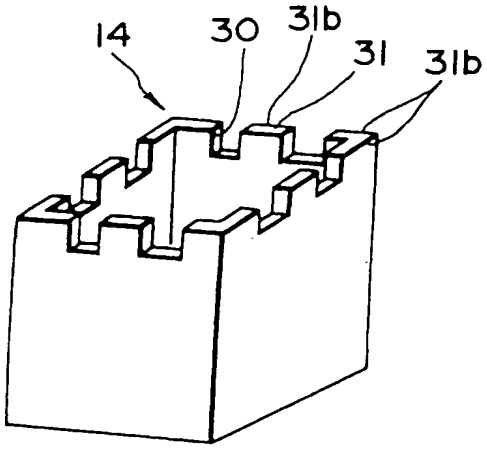

Fig. 18

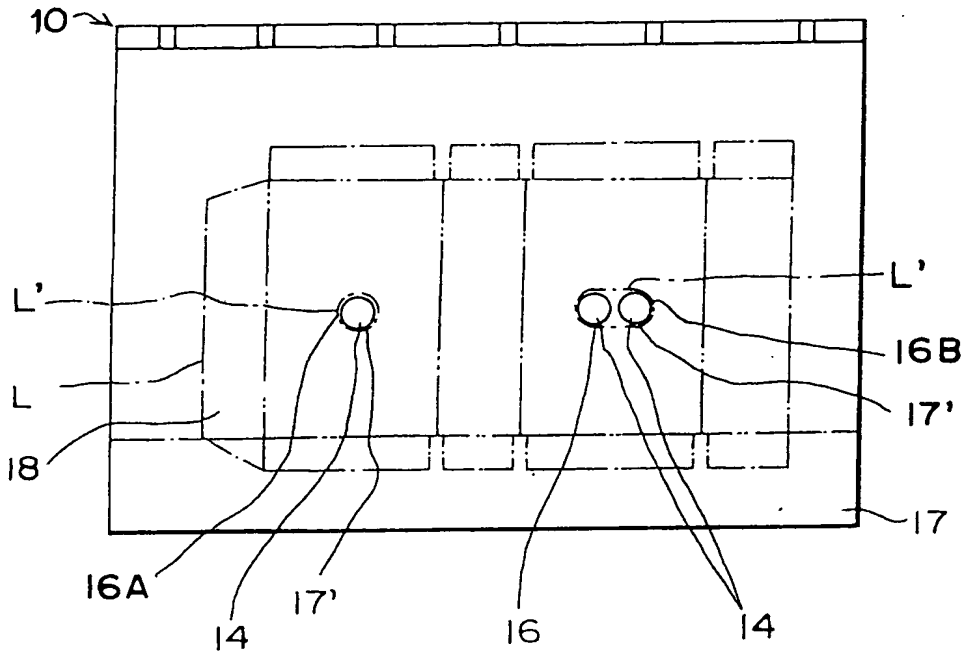

Fig. 19A

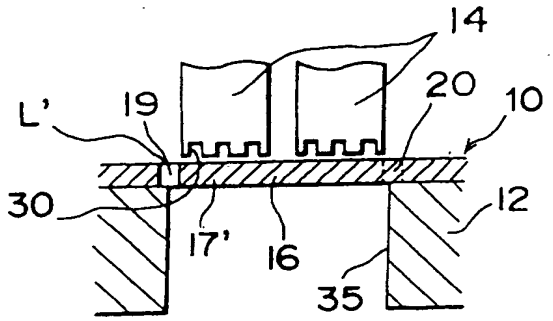

Fig. 19B

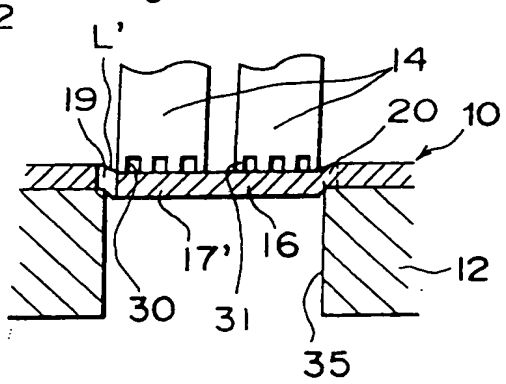

Fig. 19C

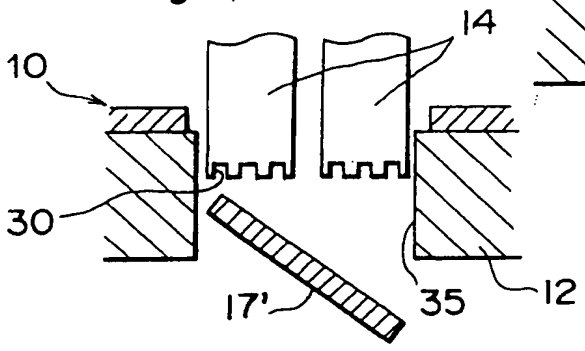

Fig. 21A

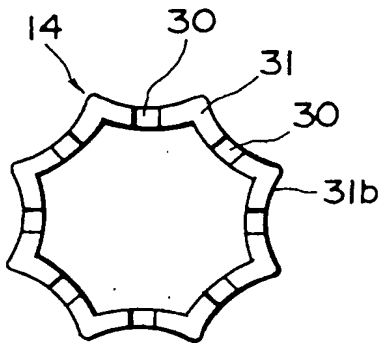

Fig. 21B

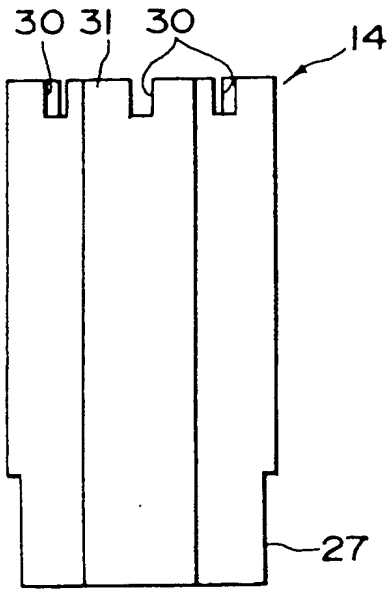

Fig. 22A

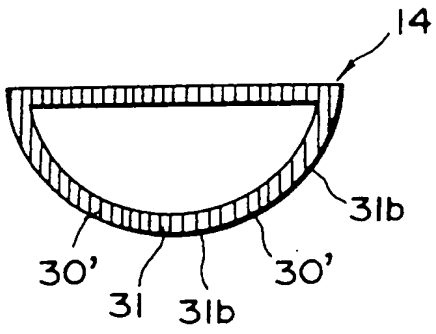

Fig. 22B

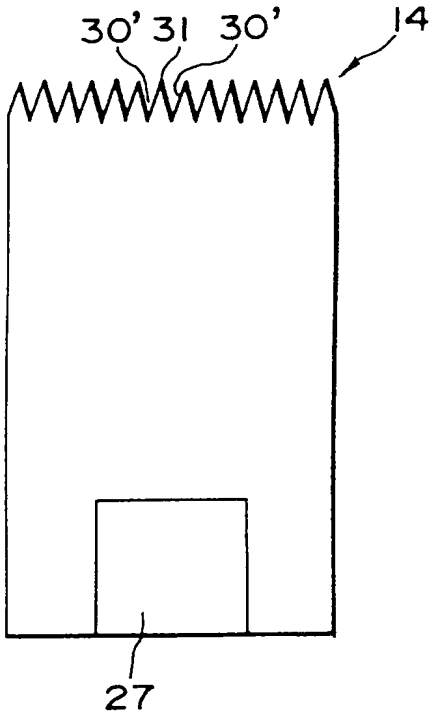

Fig. 23

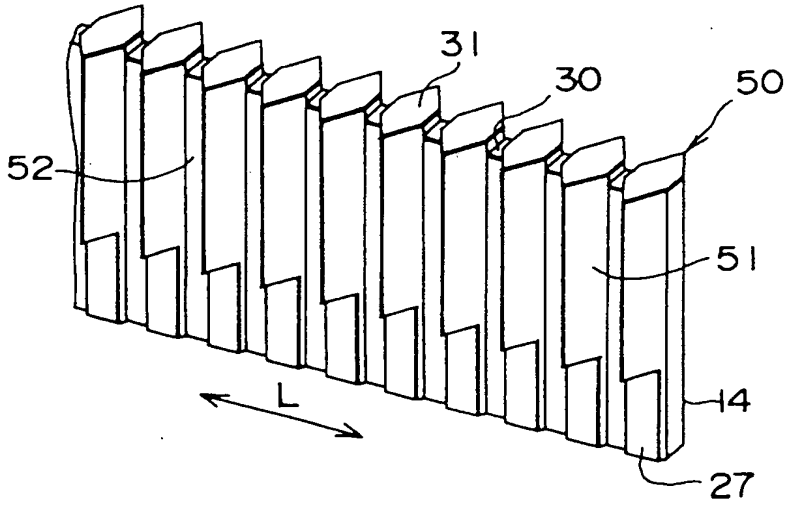

Fig. 25

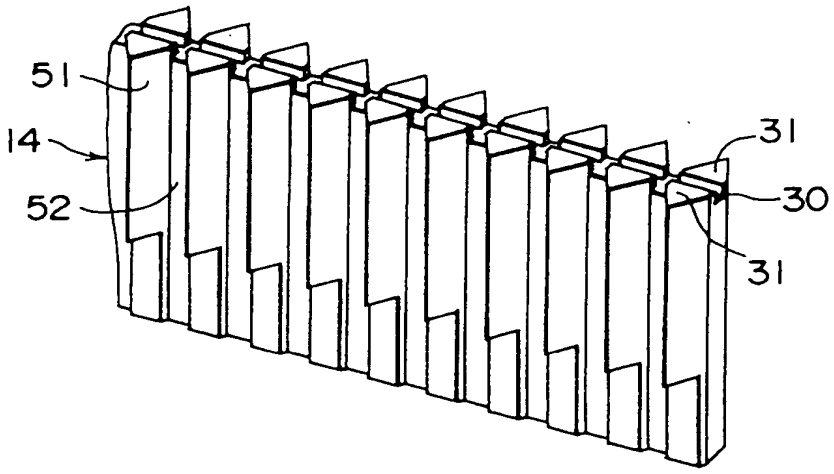

Fig. 24A

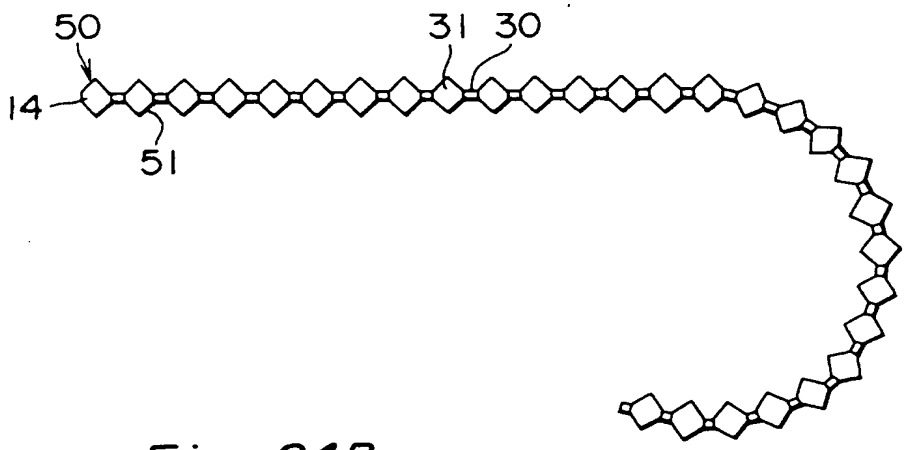

Fig. 24B

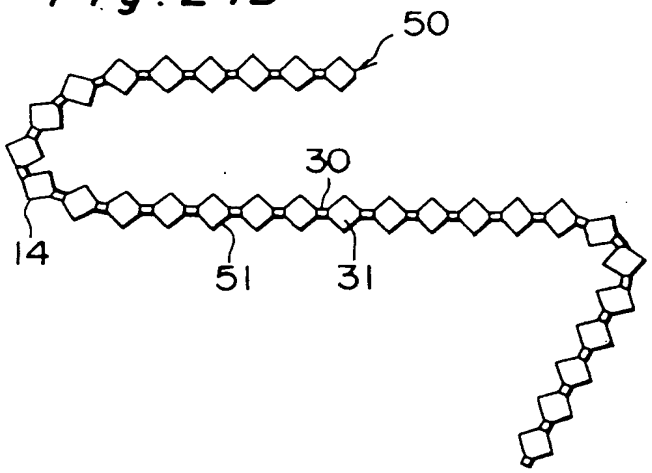

Fig. 24C

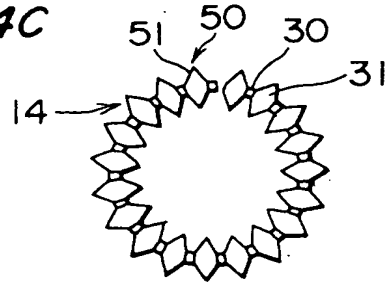

Fig. 26 PRIOR ART

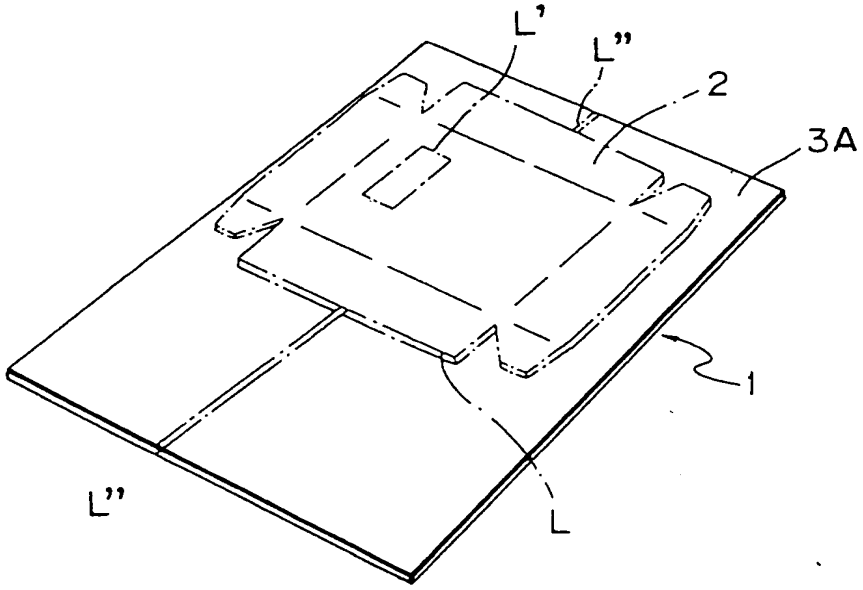

Fig. 27 PRIOR ART

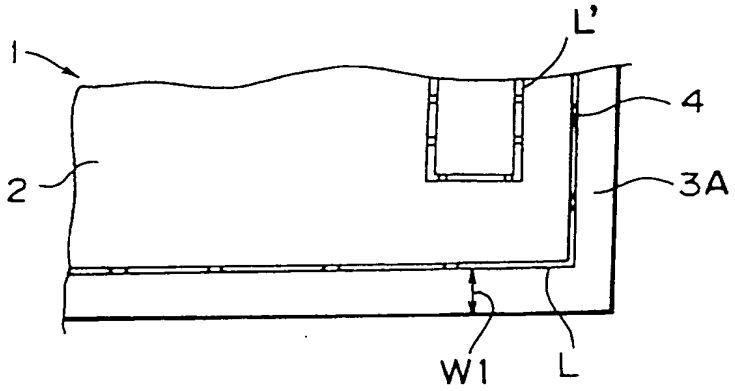

Fig. 28A PRIOR ART

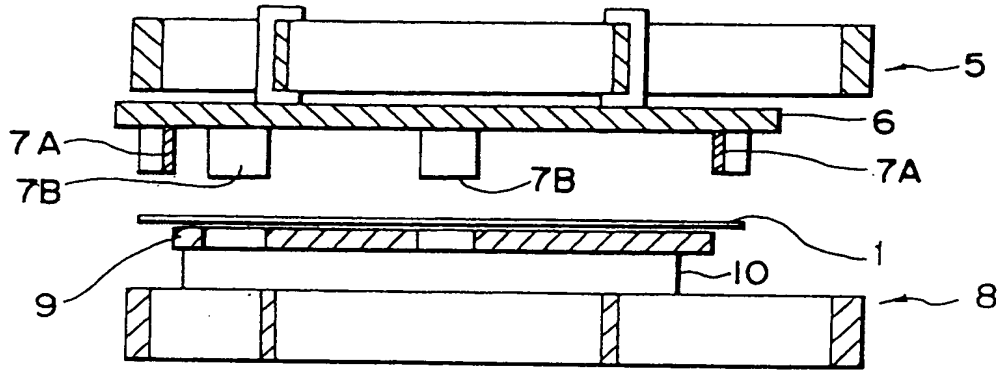

Fig. 28B PRIOR ART